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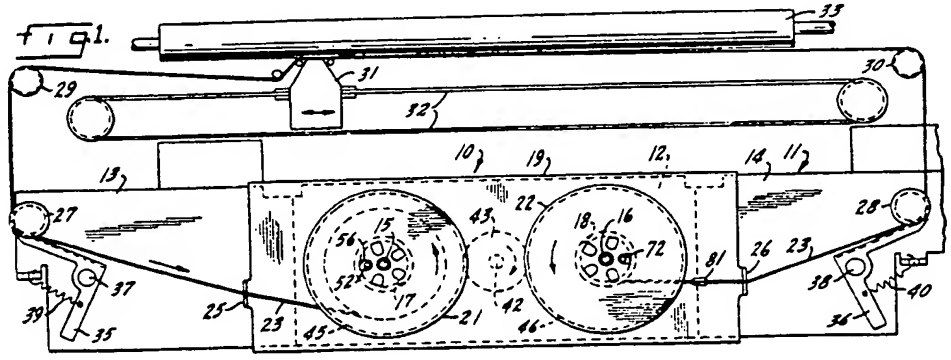
(54) Reversing ribbon drive mechanism

(57) A reversing drive mechanism for the ribbon 23 of a printer, of the kind using two ribbon storage spools 21, 22 includes two ribbon spool drive gears 45, 46 engaged by a pinion 43 driven by a synchronous inductor motor which reverses its direction of rotation whenever the motor is stalled, e.g. by engagement of a stop member 81 with a guide 26. Each drive gear is connected to one ribbon storage spool by a clutch that is responsive to the direction of motor rotation; one clutch is engaged for clockwise motor rotation and disengaged for counterclockwise rotation, and the other clutch is engaged for counterclockwise motor rotation and disengaged for clockwise rotation.



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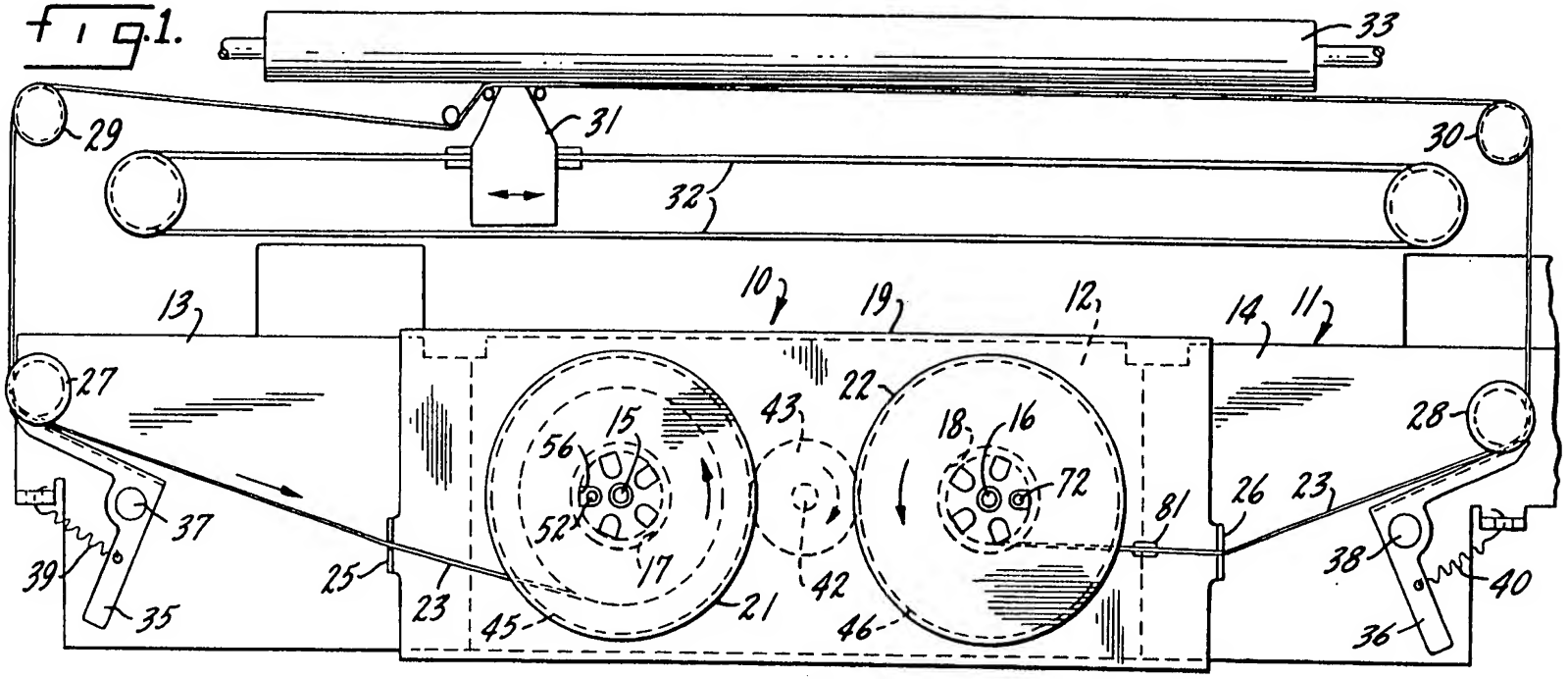
The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

fig.1.



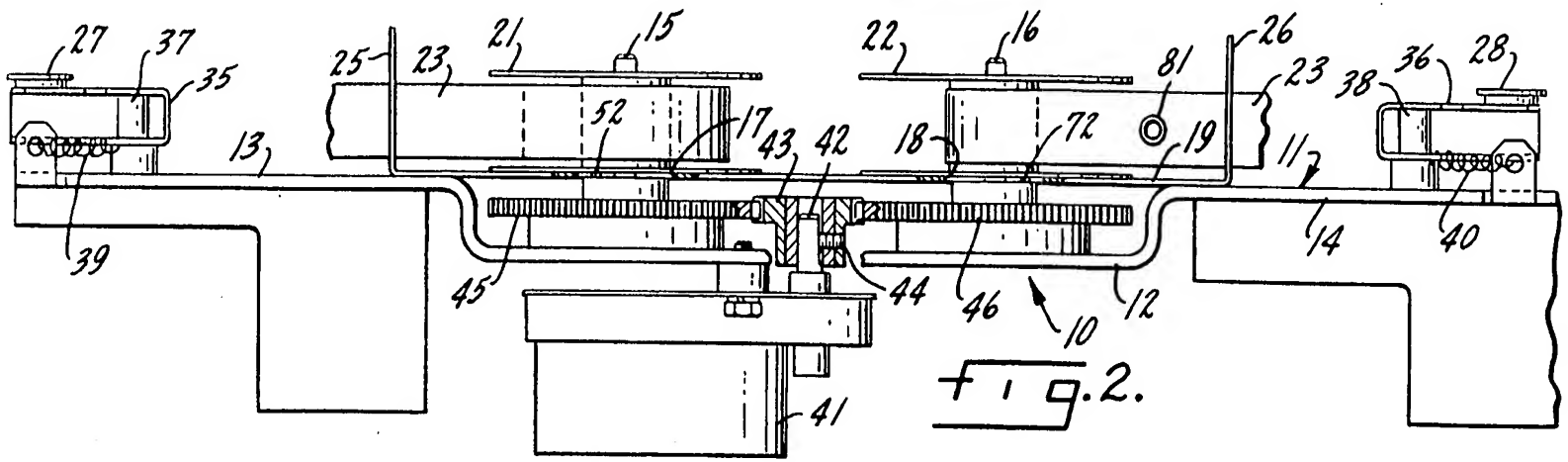


fig.2.

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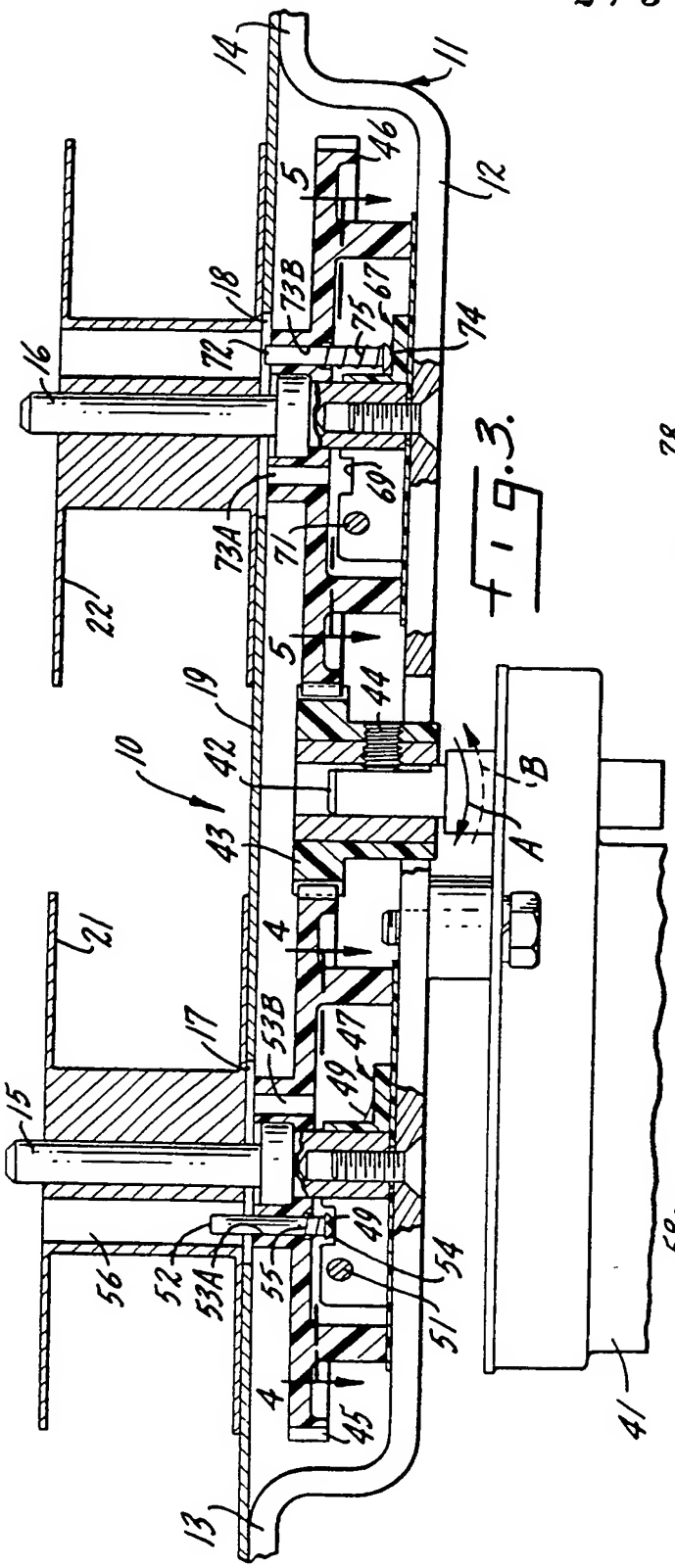


FIG. 3.

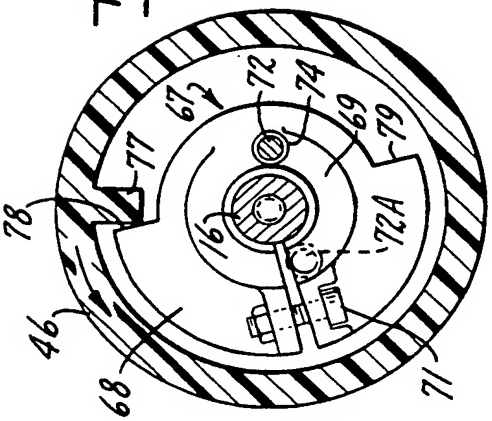


FIG. 5.

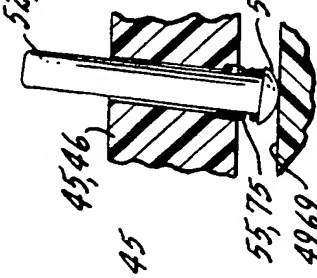


FIG. 6.

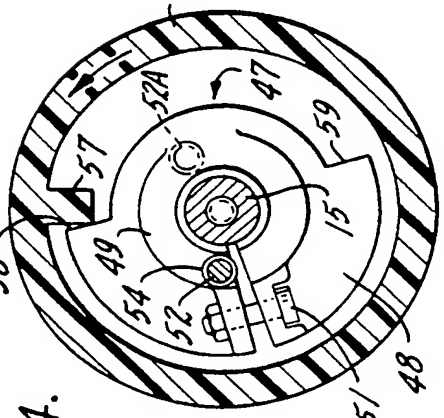


FIG. 4.

Fig. 7.

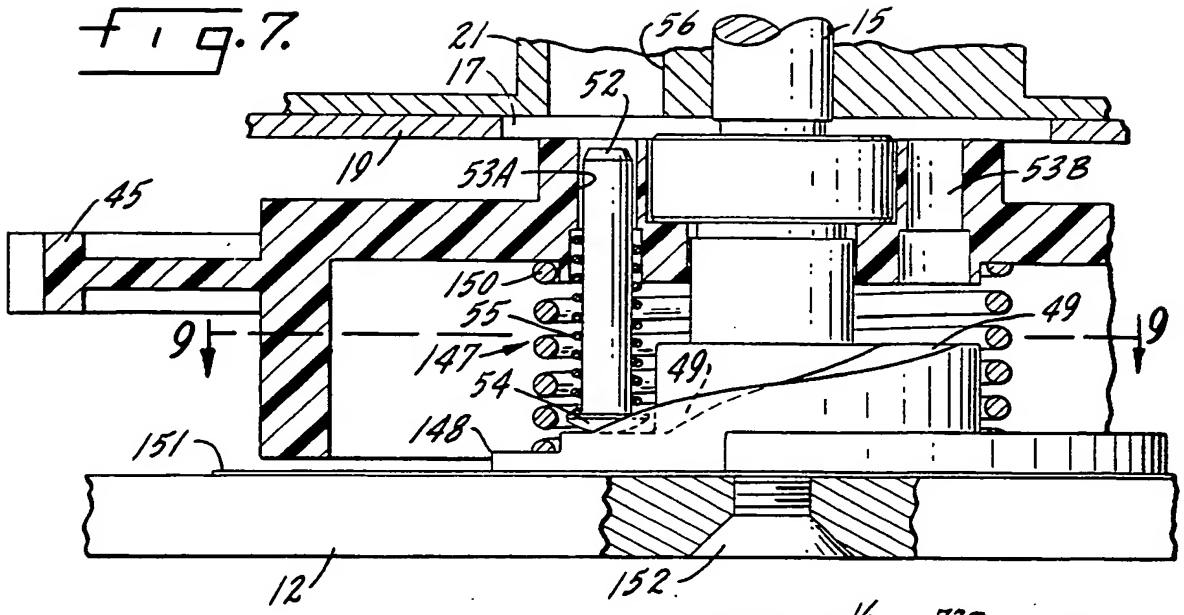


Fig. 8.

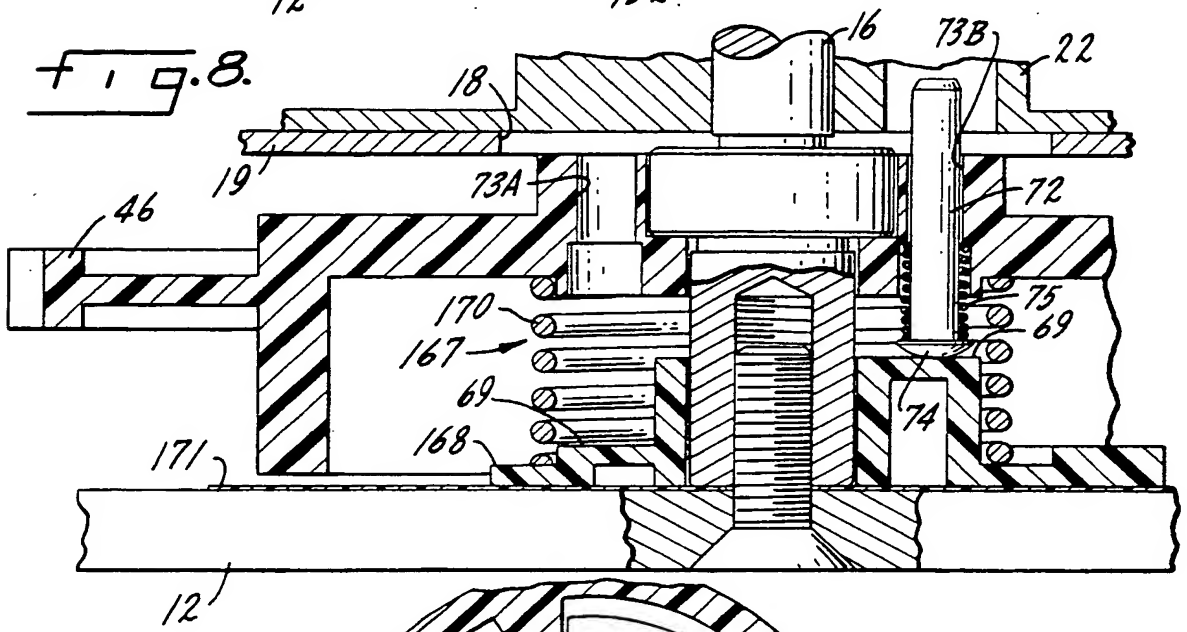
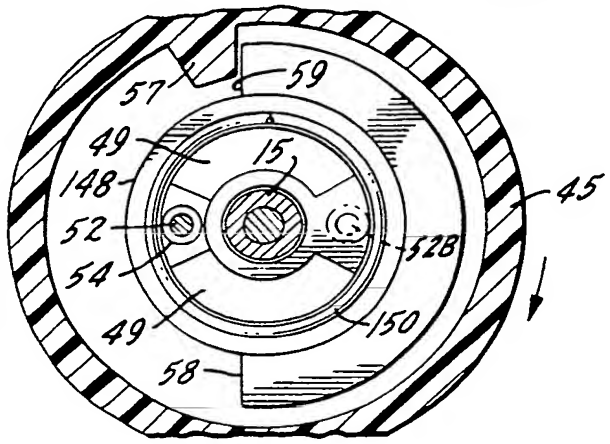


Fig. 9.



SPECIFICATION

Reversing ribbon drive mechanism

Technical Field

There are many forms of printer, including typewriters, teleprinters, computer printout machines, and the like, that employ a print ribbon extending between two ribbon storage spools. To obtain efficient and effective use of the entire ribbon, and to avoid excessive printing from any given portion of the ribbon, it is necessary to provide a drive mechanism that reverses the direction of movement of the print ribbon whenever the ribbon has been paid out completely from one of the storage spools. The technical field of the present invention is that of a reversing ribbon drive mechanism for such a printer.

Background Art

Perhaps the most common form of reversing print ribbon drive mechanism utilizes two rivets or other like members affixed to the ribbon near its ends, in conjunction with two sensor switches that each detect movement of one of the rivets outwardly of the associated storage spool to determine when it is necessary to reverse the direction of ribbon movement. Upon detection of this condition, the electrical connections for a ribbon drive motor are changed to reverse the direction of motor rotation. In addition, a change is effected in the drive connection from the motor to the spools, such that one spool previously driven as a takeup spool is released from its drive connection to the motor and the other spool, which has been idling, is engaged in a driving connection to function as a ribbon takeup spool. The drive connection change is usually effected mechanically by a clutch mechanism. A good example of a reversing ribbon drive mechanism of this type is presented in Kranz et al United States Patent No. 3,954,167. This type of reversing ribbon drive mechanism functions quite satisfactorily, but is relatively complex and expensive, in part due to the necessity of providing two complete sensor mechanisms to detect the end of a ribbon and to effect the reversal of rotational movement for the motor. Furthermore, devices of this kind often experience operational difficulties, usually in the clutch employed to shift the drive connection from one ribbon storage spool to the other.

Another type of prior art mechanism employs separate gear trains to drive the two ribbon spools in opposite directions from a motor that always rotates in one direction. A clutch, mecanically actuated by stalling of rotation of the ribbon spools, is used to change from driving one spool to the other. Examples of completely mechanical drives of this type, each using a motor that rotates in only one direction, are presented in Stahl et al United States Patent No. 2,693,871 and Cavella United States Patent No. 3,670,981. In general, the clutches in these devices tend to be relatively complex and expensive. Furthermore, the clutch mechanisms entailed are sometimes rather undependable.

Yet another construction for a reversing ribbon drive mechanism for a printer, limited to use in a printer employing a moving print head, is disclosed in Bittner United States Patent No. 3,939,957. This device utilizes two pulleys engaged by a stationary gear belt, rotation of the pulleys being derived from movement of the print head carriage, on which they are mounted, across the platen of the printer. This arrangement provides a continuous drive for the two pulleys whenever printing is in progress. A sensor mechanism is provided to detect the ends of the ribbon, similar to some other prior art arrangements; that sensor provides for alternate actuation of two clutches connecting the pulleys to the ribbon spools. This device also requires two additional clutches to disengage the drive during return movement of the carriage.

Disclosure of Invention

It is a principal object of the present invention, therefore, to provide a new and improved reversing ribbon drive mechanism for a printer of the kind that employs a print ribbon extending between first and second ribbon storage spools, which mechanism is simple, inexpensive, and highly reliable in operation as compared with the devices of the prior art.

Another object of the invention is to provide an improved, reliable reversing ribbon drive mechanism of simple and economical construction that can be used with any form of printing apparatus employing a print ribbon.

A particular object of the invention is to provide a new and improved reversing ribbon drive mechanism for a printer that does not require any sensors to detect the end of the ribbon, but rather achieves reversal of the direction of ribbon movement by utilizing an electric motor that inherently reverses whenever it is stalled.

A further object of the invention is to provide a new and improved reversing ribbon drive mechanism for a printer that incorporates simple and inexpensive clutches to change the drive from one spool to another directly in response to reversal of the direction of rotation of a ribbon drive motor.

Accordingly, the invention relates to a reversing ribbon drive mechanism for a printer having a print ribbon extending between first and second ribbon storage spools, comprising a reversible electric motor, means for reversing the direction of rotation of the motor in response to transfer of essentially all of the ribbon from one spool to the other, drive connection means, including first and second

rotary spool drive members aligned with the first and second ribbon storage spools, for connecting the motor in driving relation to each of the ribbon storage spools, and clutch means, incorporated in the drive connection means, for effectively coupling the motor to only one of the two storage spools at any given time. The improvement of the invention comprises a motor having an operating characteristic that causes the motor to reverse its direction of rotation when the motor is stalled without requiring external sensors responsive to ribbon transfer, and clutch means that is responsive to changes in the direction of rotation of the motor, changing the drive connection from one spool to the other each time the motor reverses it rotation.

Brief Description of the Drawings

Figure 1 is a plan view of a reversing ribbon drive mechanism constructed in accordance with the invention, including a schematic illustration of the platen and print head of a printer in which the mechanism may be incorporated;

Figure 2 is an elevation view, partly in cross section, of the reversing ribbon drive mechanism of Fig. 1;

Figure 3 is a sectional elevation view, on a larger scale, of the reversing ribbon drive mechanism of Figs. 1 and 2, using one form of directional responsive clutch;

Figure 4 is a detail section view taken approximately along line 4–4 in Fig. 3;

Figure 5 is a detail section view taken approximately along line 5–5 in Fig. 3;

Figure 6 is a detail section view of a clutch drive pin used in the mechanism of Figs. 3–5;

Figures 7 and 8 are sectional elevation views, on an enlarged scale, of a second form of directional responsive clutch for the reversing ribbon drive mechanism of Figs. 1 and 2; and

Figure 9 is a detail sectional view taken approximately along line 9–9 in Fig. 7;

Best Mode for Carrying Out the Invention

Figs. 1–6 illustrate a reversing ribbon drive mechanism 10 comprising a first embodiment of the present invention. Mechanism 10 includes a main frame 11 having a depressed central portion 12 and two elevated side portions 13 and 14. A first ribbon spool mounting post 15 is affixed to and projects upwardly from the left-hand side of the depressed central frame portion 12 as seen in Figs. 2 and 3, extending well above the adjacent side portion 13 of the frame. A second ribbon spool mounting post 16 is similarly mounted at the right-hand side of the central portion 12 of frame 11. Posts 15 and 16 project through two openings 17 and 18, respectively, in a cover 19 that is mounted on frame 11 and extends across the central portion 12 of the frame.

A first ribbon storage spool 21 is rotatably mounted upon post 15 above cover 19; a second ribbon storage spool 22 is similarly mounted upon post 16. A print ribbon 23 extends outwardly from spool 21 through a narrow slot in a vertical ribbon guide 25 that is formed as an integral part of cover 19. From guide 25, ribbon 23 extends around a fixed guide 27 mounted on the elevated left-hand portion 13 of frame 11 and around a further guide 29 into engagement with a print head 31. From print head 31, ribbon 23 continues around a guide 30 into engagement with a fixed guide 28 mounted on the right-hand frame portion 14 and through a slotted guide 26 to the second spool 22. Guide 26, like guide 25, is formed integrally with cover 19.

In the following arrangement, the reversing ribbon drive mechanism 10 is shown with a printer of the type employing a movable print head 31, driven by a belt 32 across a platen 33 used to support a sheet of paper or other record medium (not shown). Print head 31, for example, may be a dot matrix print head. However, the ribbon drive mechanism 10 is not limited to use with any particular print apparatus. It is equally applicable to a line printer in which there is no print head movement. Mechanism 10 can also be used with a printer employing individual type levers, a rotary ball print element, or any other printing mechanism that employs a print ribbon.

At the left-hand side of mechanism 10, as shown in Figs. 1 and 2, a brake arm 35 is pivotally mounted on a brake arm shaft 37 that is affixed to frame portion 13. A spring 39 biases brake arm 35 in a clockwise direction, holding ribbon 23 against the fixed guide 27. At the right-hand side of mechanism 10 there is a simialr brake device comprising a brake arm 36 mounted on a shaft 38 and biased counterclockwise by a spring 40.

As best shown in Figs. 2 and 3, an electric motor 41 is mounted on the bottom of the depressed central portion 12 of frame 11 with the motor output shaft 42 projecting upwardly above frame portion 12. Motor 41 has an operating characteristic that causes the motor to reverse its direction of rotation when the motor is stalled; a synchronous induction motor is preferably used because it has that characteristic. As shown, motor 41 is a gear motor, affording a substantial speed reduction; in a typical construction, the gear reduction ratio may be of the order of 60:1.

A pinion gear 43 is affixed to the motor output shaft 42 by suitable means such as a set screw 44. Pinion 43 is aligned in meshing engagement with two ribbon spool drive members, the gears 45 and 46. The first ribbon spool drive member, gear 45, is coaxially aligned with the first ribbon storage spool 21, being journalled for rotation about post

15. The second ribbon spool drive member, gear 46, is journalled on post 16 and hence is coaxially aligned with the second ribbon storage spool 22.

Mechanism 10 includes a first clutch 47 for coupling the first spool drive member 45 in driving relation to the first ribbon storage spool 21 when the clutch is engaged. Clutch 47 includes a rotary cam 48 journalled on the lower portion of post 15 and hence coaxially aligned with both drive member 45 and ribbon spool 21. Cam 48 includes an inclined cam track 49. As best shown in Fig. 4, cam 48 is of split construction and is provided with a screw 51 that permits adjustment of frictional drag between cam 48 and post 15.

Clutch 47 further comprises a drive pin 52 positioned in an aperture 53A in drive member 45. Drive member 45 includes a second similar drive pin aperture 53B, but aperture 53B is not used in clutch 47. The lower end of drive pin 52 comprises a head 54 that rides on the inclined cam track 49 of cam 48 (Figs. 3 and 4). A spring 55 (Fig. 3) maintains head 54 of pin 52 in engagement with the cam track. For the operating condition illustrated in Figs. 2 and 3, pin 52 projects upwardly through opening 17 in cover 19 and into one of several apertures 56 in spool 21 to afford a driving connection to the spool.

As best shown in Fig. 4, clutch 47 includes a lost-motion connection comprising an internally projecting lug 57 on drive member 45 that is positioned for engagement by either one of two shoulders 58 and 59 formed on cam 48. For the operating condition illustrated in the drawings, in which spool 21 is being driven counterclockwise to function as a ribbon takeup spool, lug 57 engages cam shoulder 58 in driving relation. If the direction of rotation of drive member 45 is reversed, however, lug 57 is engageable with shoulder 59.

Mechanism 10 further comprises a second clutch 67, essentially similar in construction to the first clutch 47. Thus, the second clutch 67 includes a cam 68 having an inclined cam track 69; cam 68 is journalled on post 16 (Figs. 3 and 5). As in the case of the first clutch, a friction adjustment screw 71 is provided to vary the frictional engagement between post 16 and cam 68. Clutch 67 further includes a spool drive pin 72 positioned in an aperture 73B in the rotary spool drive member 46. Driving member 46 has a second drive pin aperture 73A, corresponding to aperture 53A of drive member 45, but aperture 73A is not used in clutch 67. The double pin aperture construction is used merely to assure full interchangeability of parts. A spring 75 maintains the head 74 of pin 72 in engagement with cam track 69. For this operating condition shown in Figs. 2, 3 and 5, pin 72 is on the lower portion of cam track 69 and does not project high enough to engage the second ribbon spool 22 (see Fig. 3), so that spool 22 idles on its post 16.

Clutch 67, like the first clutch 47, provides a lost motion connection between the spool drive member 46 and cam 68. The construction is the same as in the first clutch; an internal lug 77 on drive member 46 is engeable with either one of two shoulders 78 and 69 on cam 68. For the operating condition illustrated in the drawings, with the drive member 46 rotating counterclockwise, lug 77 engages shoulder 78 and rotates cam 68 counterclockwise (Fig. 5).

To assure effective engagement of the drive pins with the ribbon storage spools, in mechanism 10, the drive pin mounting apertures 53A, 53B, 73A, and 73B in the drive members 45 and 46 are inclined slightly relative to the spool axes, determined by posts 15 and 16. An inclination of as little as 5° is adequate for this purpose, as shown in Fig. 6. This inclination of the drive pin in each clutch precludes the spool riding up over the drive pin when the clutch is engaged.

Motor 41 is continuously energized during printing and preferably is kept energized for a short time interval (e.g, ten seconds) following interruption of printing. For the operating condition of mechanism 10 illustrated in the drawings, motor output shaft 42 is rotating in a clockwise direction (arrow A); all angular directions are stated in relation to the plan view, Fig. 1. In consequence, spool drive member 45 is driven counterclockwise by pinion 43. The drive connection provided by clutch 47, through pin 52, also rotates spool 21 counterclockwise. Thus, spool 21 functions as a takeup spool, pulling ribbon 23 from spool 22 along the path defined by guides 25–30. For this operating condition, clutch 67 is disengaged and there is no drive connection to spool 22, which idles on post 16, though gear 46 rotates continuously in a counterclockwise direction.

As shown in Figs. 1–3, almost all of ribbon 23 has been pulled from spool 22 onto spool 21. Thus, mechanism 10 is approaching the time when a reversal of direction of movement of ribbon 23 is necessary. In the illustrated arrangement, ribbon 23 is provided with a rivet or other stop member 81 affixed to the ribbon near the end that is secured to spool 22. When rivet 81 reaches guide 26, it cannot pass through the narrow slot in that guide and ribbon movement is interrupted. It should be noted that it is not essential to use a rivet or similar stop member 81; the required interruption when the end of the ribbon is reached can be achieved simply by having the ribbon securely fastened to spool 22.

When the movement of ribbon 23 is thus interrupted, motor 41 is stalled. As noted above, motor 41 is a synchronous induction motor or other motor having an operating

characteristic such that the motor reverses its direction of rotation when stalled. Consequently, motor 41 now begins to rotate its output shaft 42 counterclockwise as indicated by arrow B. This counterclockwise rotation of shaft 42 drives both spool drive members 45 and 46 clockwise, opposite to their previous direction of rotation.

As spool drive member 46 begins clockwise rotation, lug 77 moves away from shoulder 78. Cam 68 does not follow this initial movement of drive member 46, due to the limited frictional engagement with post 16, determined by adjustment screw 71. Because drive 72 is mounted in aperture 73B in drive member 46 (Fig. 3), the drive pin moves along the inclined cam track 69 (see Fig. 5) and is driven upwardly toward engagement with one of the apertures in the bottom of spool 22. With continued clockwise rotation of drive member 46, pin 72 reaches its engaged position 72A (Fig. 5); as clutch 67 is thus engaged, lug 77 comes into contact with shoulder 79. Thereafter, drive member 46 and cam 68, and spool 22 rotate conjointly in a clockwise direction so that spool 22 functions as a takeup reel pulling ribbon from spool 21 along the path defined by guides 25–30.

The clockwise rotation imparted to drive member 45 by the reversal of motor 41 also disengages clutch 47. Thus, as drive gear 45 begins to rotate clockwise, lug 57 moves clear of shoulder 58. Cam 48 does not follow this movement, due to the light frictional engagement between the cam and post 15. Pin 52 must follow the rotational movement of drive member 45 and, accordingly, moves downwardly along the inclined cam track 49 to the alternate disengaged position 52A (Fig. 4). After approximately one-half revolution, lug 57 engages shoulder 59 on cam 48; thereafter, the cam continues rotation conjointly with drive member 45. Spring 55, however, has now driven pin 52 downwardly, along cam track 49, so that the drive pin is disengaged from spool 21 and that spool now idles on post 15. The brakes 35 and 36 (Fig. 1) prevent uncontrolled movement of ribbon 23.

When the full working length of ribbon 23 has been pulled from spool 21, movement of ribbon 23 is again interrupted and motor 41 is again stalled. As a consequence, the motor reverses its direction of rotation from counterclockwise to clockwise. This effectively disengages clutch 67 and engages clutch 47 in the manner described above, restoring spool 21 to takeup operation with spool 22 reverting to an idling condition. There is a brief pause in ribbon movement during each period in which the two clutches change between their engaged and disengaged conditions, but this is not detrimental to the overall operation of mechanism 10.

As illustrated, mechanism 10 employes a direct gear drive through pinion 43 and the two drive gears 45 and 46. However, if it is inconvenient to mount motor 41 immediately adjacent clutches 47 and 67, a belt drive can be employed, utilizing pulleys to replace the two drive gears. In any such arrangement, a gear belt drive arrangement is preferred.

From the foregoing description, it will be apparent that the reversing ribbon drive mechanism 10 eliminates any requirement for devices to sense the end of the ribbon; reversal of the direction of rotation of motor 41 is effected by utilizing a motor having an operating characteristic that causes the requisite reversal when the motor is stalled. The two simple clutches 47 and 67, on the other hand, being directly responsive to the direction of rotation of motor 41, effectively change the drive connection from one spool to the other in accordance with the the requirements for ribbon movement. Overall, mechanism 10 is quite simple and inexpensive in construction, as compared with previously known devices, yet is highly reliable in operation and should afford a long operating life with few maintenance problems. Mechanism 10 can be used with any printer apparatus employing a print ribbon; it is not dependent upon any specific printing mechanism. Clutches 47 and 67 require no critical adjustments. Indeed, the only adjustment necessary is the frictional drag of the cams 48 and 68 on posts 15 and 16, and that adjustment is not really critical in nature.

Although the directional responsive clutches 47 and 67 of Figs. 3–5 are highly satisfactory in operation, when properly adjusted to provide limited friction between the cams 48 and 49 and their mounting posts 15 and 16, they are subject to an operation change whenever, with extended use, wear on the cams or the mounting posts produces an appreciable reduction in in the frictional engagement. If the frictional drag for one cam is reduced enough, by such wear, that cam may follow its associated drive member immediately upon a reversal of the motor direction, being pulled along by a weak driving connection through the drive pin of the clutch. This can produce an undesirable malfunction.

Figs. 7–9 illustrate directional clutches 147 and 167 in which this type of malfunction due to reduction in the ligh frictional drag on the clutch cams is effectively eliminated. As shown in Fig. 7, clutch 147 comprises a rotary cam 148 jounalled on the lower portion of the mounting post 15 for the first ribbon spool 21. In this instance, however, the cam is loosely jounalled on the post, with no more than minimal friction (and wear) between the two. Cam 148, unlike its counterpart 48 (Figs. 3, 4) is not of split construction, since there is no need for adjustment of frictional engagement between the cam and post 15.

In most other respects clutch 148 (Fig. 7) is essentially similar to clutch 48 (Fig. 3); cam

148 has an inclined cam track 49 on which the head 54 of drive pin 52 rides, with spring 55 maintaining the drive pin engaged with the cam track. As before, drive pin 52 extends into aperture 53A in drive member 45; aperture 53B is not used. Shoulders 58 and 59 on cam 148, as on cam 48, are engageable with the internal lug 57 on drive member 45 (Fig. 9).

The light frictional drag required for consistent operation of cam 148 (Figs. 7, 9) is provided by a spring 150 that biases the cam downwardly into frictional engagement with a large, thin plastic washer 151 mounted on the upper surface of frame portion 12 in encompassing relation to the mounting screw 152 for post 15. The upper end of spring 150 bears against the lower surface of drive member 45.

Clutch 167, Fig. 8, employs the same construction as clutch 147. It comprises a rotary cam 168 relatively loosely jounalled on the lower portion of the mounting post 16 for the second ribbon spool 22. Like the previously described cam 67, cam 167 has an inclined cam track 69 on which the head 74 of drive pin 72 rides. Pin 72 extends through aperture 73B of drive member 45, as before; the other aperture 73A is not used in clutch 167. Pin 72 is again biased downwardly, toward cam track 169, by spring 75. As in clutch 147, the cam 168 of clutch 167 is biased downwardly into frictional engagement with a plastic wear washer 171 on frame portion 12 by a spring 170, the upper end of spring 170 engaging the bottom surface of drive member 46.

In Figs. 7–9, clutch 147 is shown disengaged whereas clutch 167 is engaged; this is the condition that obtains when both drive members 45 and 46 are being rotated clockwise, as viewed from above and indicated by the arrow in Fig. 9. For this condition, ribbon spool 22 functions as a takeup spool and spool 21 idles; it is the alternate condition to that shown in Fig. 1;

When almost all of the ribbon has been pulled from spool 21 to spool 22, motor 41 stalls and reverses its direction, as before, so that drive members 45 and 46 now begin to rotate counterclockwise. When drive member 45 begins its counterclockwise rotation, cam 148 does not follow immediately; frictional drag between the cam and washer 151, aided by spring 150, restrains the cam. Rotation of drive member 45, relative to cam 148, through an angle of somewhat less than 180°, causes the drive pin 52 to ride up the inclined cam track 49 from the disengaged postion 52 to the engaged position 52B (Fig. 9). The same relative rotation between drive member 46 and cam 168 in clutch 167, assured by the frictional drag between cam 168 and washer 171 aided by spring 170 (Fig. 8) causes drive pin 72 to ride down the inclined cam surface 169 to its disengaged position.

After the continuing counterclockwise rotation of drive member 45 brings its lug 57 into engagement with shoulder 58 on cam 148, the cam and drive member rotate CCW, conjointly. Since the drive pin 52 is now raised into engagement with spool 21, that spool functions as a takeup spool as indicated in Fig. 1. Conversely, though drive member 46 and cam 168 are now drivingly interconnected, spool 22 idles because drive pin 72 has returned to its lowered, disengaged position responsive to the bias provided by spring 75. It is thus seen that on each reversal of motor 42, effected by stalling the motor as described in conjunction with Figs. 1–5, clutches 147 and 167 act to reverse the direction of ribbon movement in the same basic manner as the clutches 47 and 67.

Clutches 147 and 167, unlike clutches 47 and 67, do not tend to malfunction with continuing wear due to extended long term usage. Wear on the frictionally engaged surfaces of cam 148 and washer 151 in clutch 147 is effectively compensated by spring 150; the same is true for cam 168, washer 171, and spring 170 in clutch 167.

In addition to improved performance with long term use, clutches 147 and 167 provide an effective cost reduction as compared with clutches 47 and 67. Because cams 148 and 168 do not require the split construction of cams 48 and 68, they are substantially less expensive to manufacture. Another saving arises from elimination of the adjustment screws 51 and 71 (Figs. 35). These cost reductions more than offset the cost of springs 150 and 170. Furthermore, the initial frictional adjustment required for cams 48 and 68 is eliminated with cams 148 and 168, with some attendant labor savings in assembly of the clutches 147 and 167.

CLAIMS

1. In a reversing ribbon drive mechanism for a printer having a print ribbon extending between first and second ribbon storage spools, of the kind comprising:

a reversible electric motor and means for reversing the direction of rotation of the motor in response to transfer of essentially all of the ribbon from one spool to the other;

drive connection means, including first and second rotary spool drive members aligned with the first and second ribbon storage spools, for connecting the motor in driving relation to each of the ribbon storage spools;

and clutch means, incorporated in the drive connection means, for effectively coupling the motor to only one of the two storage spools at any given time;

the improvement comprising:

the motor having an operating characteristic that causes the motor to reverse its direction

of rotation when the motor is stalled without requiring external sensors repsonsive to ribbon transfer;

and the clutch means being responsive to changes in the direction of rotation of the motor to change the drive connection from one spool to the other each time the motor reverses its rotation.

2. A reversing ribbon drive mechanism according to Claim 1 in which the motor is a synchronous inductor motor.

3. A reversing ribbon drive mechanism according to Claim 1 or Claim 2 in which both spool drive members are driven continuously by the motor and in which the clutch means comprises:

a first clutch, coupling the first spool drive member in driving relation to the first ribbon storage spool when the clutch is engaged;

and a second clutch, coupling the second spool drive member in driving relation to the second ribbon storage spool when the clutch is engaged;

each clutch being responsive to the direction of rotation of the motor, so that the clutch is engaged by rotation of the motor in one direction and is disengaged by rotation of the motor in the opposite direction, the clutch-engaging directions for the two clutches being opposite to each other.

4. A reversing ribbon drive mechanism according to Claim 3 in which each spool drive member is a spur gear positioned in coaxial alignment with its associated ribbon storage spool, and in whch the drive connection means comprises a pinion gear, driven by the motor, which is engaged with both of the spur gears.

5. A reversing ribbon drive mechanism according to Claim 3 in which each spool drive member is aligned coaxially with its associated ribbon storage spool, and in which each clutch comprises:

a rotary cam, coaxial with the spool drive member;

lost-motion drive means, interconnecting the cam and the drive member, constraining the cam to rotate with the drive member in a first angular orientation relative to the drive member for rotation of the drive member in one direction and in a second angular orientation for rotation of the drive member in the opposite direction;

and a spool drive pin, axially slidably mounted in an aperture in the spool drive member, the cam engaging the pin to maintain the pin in an engaged position projecting into engagement with the ribbon storage spool when the cam is in one orientation and in a disengaged position clear of the spool when the cam is in the other orientation.

6. A reversing ribbon drive mechanism according to Claim 5 in which each spool drive member has first and second drive pin apertures angularly displaced from each other, the drive pin for the first clutch being mounted in the first aperture and the drive pin for the second clutch being mounted in the second aperture so that when one clutch is engaged the other is disengaged, and each clutch including biasing means for maintaining the drive pin engagement with the cam.

7. A reversing ribbon drive mechanism according to Claim 5 in which the cam of each clutch is journalled on a fixed post on which the drive member for that clutch is also journalled, and each cam includes adjustable clamp means for varying the frictional engagement between the post and the cam.

8. A reversing ribbon drive mechanism according to Claim 5 in which the drive pin in each clutch is inclined at a slight angle to the axis of the related ribbon spool to preclude the spool riding over the drive pin when the clutch is engaged.

9. A reversing ribbon drive mechanisim according to Claim 5, in which the lost-mostion means of each clutch comprises biasing means urging the cam of that clutch into limited frictional engagement with a fixed support member.

10. A reversing ribbon drive mechanism according to Claim 9 in which the biasing means comprises a compression spring interposed between the drive member and the cam.

11. A reversing ribbon drive mechanism according to Claim 10 in which each drive member has first and second drive pin apertures angularly displaced from each other, the drive pin for the first clutch being mounted in the first aperture and the drive pin for the second clutch being mounted in the second aperture so that when one clutch is engaged the other is disengaged, and each clutch including biasing means for maintaining the drive pin in engagement with the cam.

12. A reversing ribbon drive mechanism substantially as hereinbefore described with reference to the accompanying drawings.

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